

What is claimed is:

1. A field emission device (FED) comprising:
 - 2 a substrate;
 - 3 a cathode formed over the substrate;
 - 4 micro-tips having nano-sized surface features, formed on the cathode;
 - 5 a gate insulation layer with wells each of which a single micro-tip is located in,
 - 6 the gate insulation layer formed over the substrate; and
 - 7 a gate electrode with gates aligned with the wells such that each of the micro-
 - 8 tips is exposed through a corresponding gate, the gate electrode formed on the gate
 - 9 insulation layer.
- 1 2. The field emission device of claim 1, wherein a resistor layer is formed over or beneath the cathode, or a resistor layers is formed over and beneath the cathode.
- 3 4. A method for fabricating a field emission device (FED), comprising:
 - 5 forming a cathode, a gate insulation layer with wells, and a gate electrode with gates on a substrate in sequence, and forming micro-tips on the cathode exposed by the wells;
 - 6 forming a carbonaceous polymer layer on the gate electrode, such that the wells having the micro-tips are filled with the carbonaceous polymer layer; and
 - 7 etching the carbonaceous polymer layer and the surface of the micro-tips by plasma etching using a gas mixture containing O₂ for the carbonaceous polymer layer, and a gas for the micro-tips, as a reaction gas, so that the micro-tips with nano-sized surface features are formed.
- 8 9. The method of claim 3, wherein the carbonaceous polymer layer is formed of polyimide or photoresist.
- 10 5. The method of claim 3, wherein the carbonaceous polymer layer is etched by reactive ion etching (REI).

1 6. The method of claim 5, wherein the nano-sized surface features of the
2 micro-tips are adjusted by varying the etch rates of the carbonaceous polymer layer
3 and the micro-tips.

1 7. The method of claim 6, wherein the etch rates are adjusted by varying
2 the oxygen-to-the gas for the micro-chips in the reaction gas, plasma power, or
3 plasma pressure during the etching process.

1 8. The method of claim 5, wherein the micro-tips are formed of at least
2 one selected from the group molybdenum (Mo), tungsten (W), silicon (Si) and
3 diamond, and the reaction gas is a gas mixture of O₂ and fluorine-based gas.

1 9. The method of claim 8, wherein the reaction gas comprises CF₄/O₂,
2 SF₆/O₂, CHF₃/O₂, CF₄/SF₆/O₂, CF₄/CHF₃/O₂, and SF₆/CHF₃/O₂.

1 10. The method of claim 5, wherein the micro-tips are formed of at least
2 one selected from the group molybdenum (Mo), tungsten (W), silicon (Si) and
3 diamond, and the reaction gas is a gas mixture of O₂ and chlorine-based gas.

1 11. The method of claim 10, wherein the reaction gas comprises Cl₂/O₂,
2 CCl₄/O₂, and Cl₂/CCl₄/O₂.

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